



# SP6013A

## Synchronous Rectifier Driver

### DESCRIPTION

The fundamental of SP6013A synchronous rectifier (SR) driver IC is based on our U.S. patented methods that utilize the principle of “prediction” logic circuit. The IC deliberates previous cycle timing to control the SR in present cycle by “predictive” algorithm that makes adjustments to the turn-off time, in order to achieve maximum efficiency and avoid cross-conduction at the same time. It also maintains the MOSFET’s body diode conduction at minimum level. The SP6013A is capable to adapt in almost all existing flyback converters with few adjustments considered necessary.

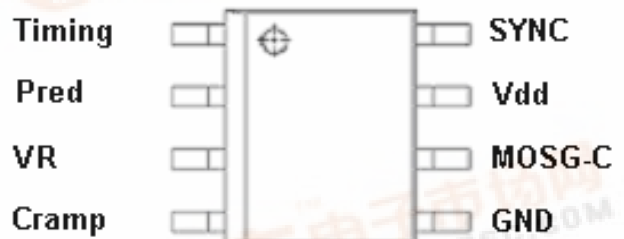
### FEATURES

- Offers efficiency improvement over Schottky Diode (depends on drive configuration of the SR).
- Drives all logic level Power MOSFET.
- Prediction gate timing control.
- Minimum MOSFET body diode conduction.
- Operating frequency up to 650 KHz.
- Synchronize to transformer secondary voltage waveform.

### APPLICATIONS

- Servers & workstations
- Storage area network power supplies
- Telecommunication converters
- Embedded systems
- Industrial & commercial systems using high current processors

### PIN CONFIGURATION (SOP-8)



### PART MARKING

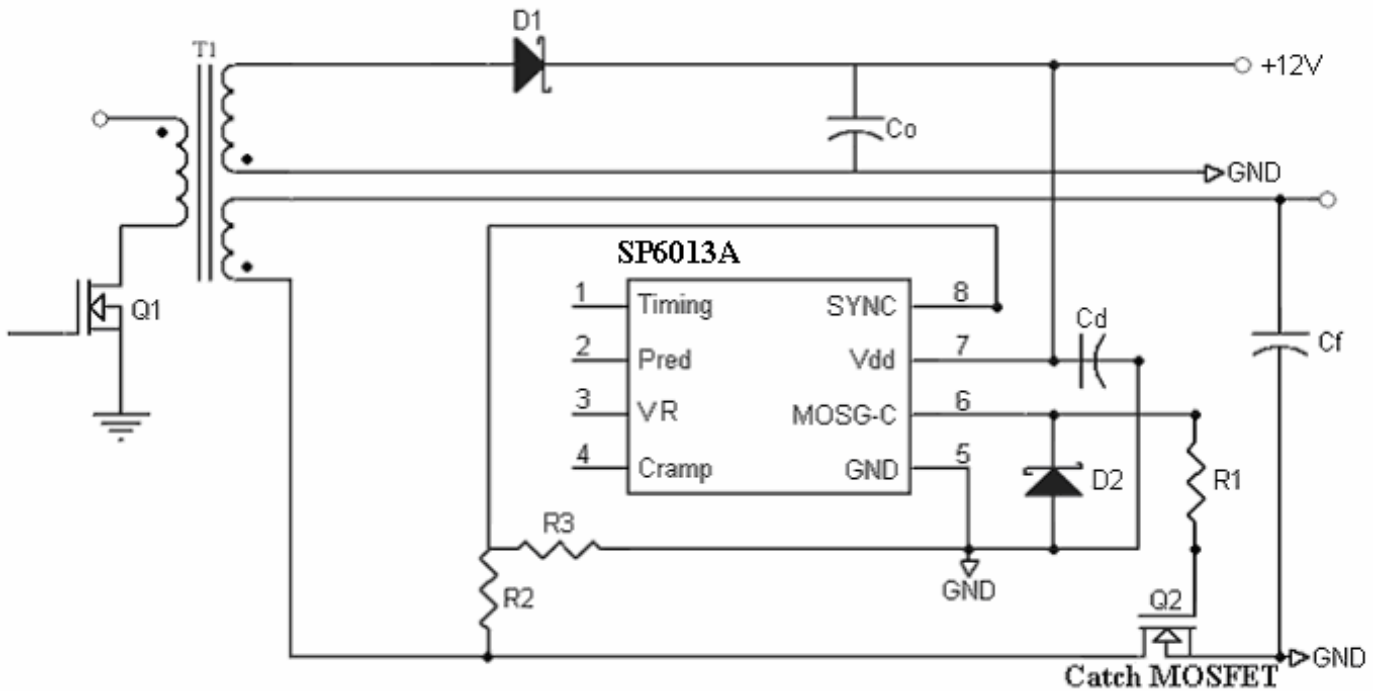


A : Lot Code  
B : Date Code



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## TYPICAL APPLICATION CIRCUIT



## PIN DESCRIPTION

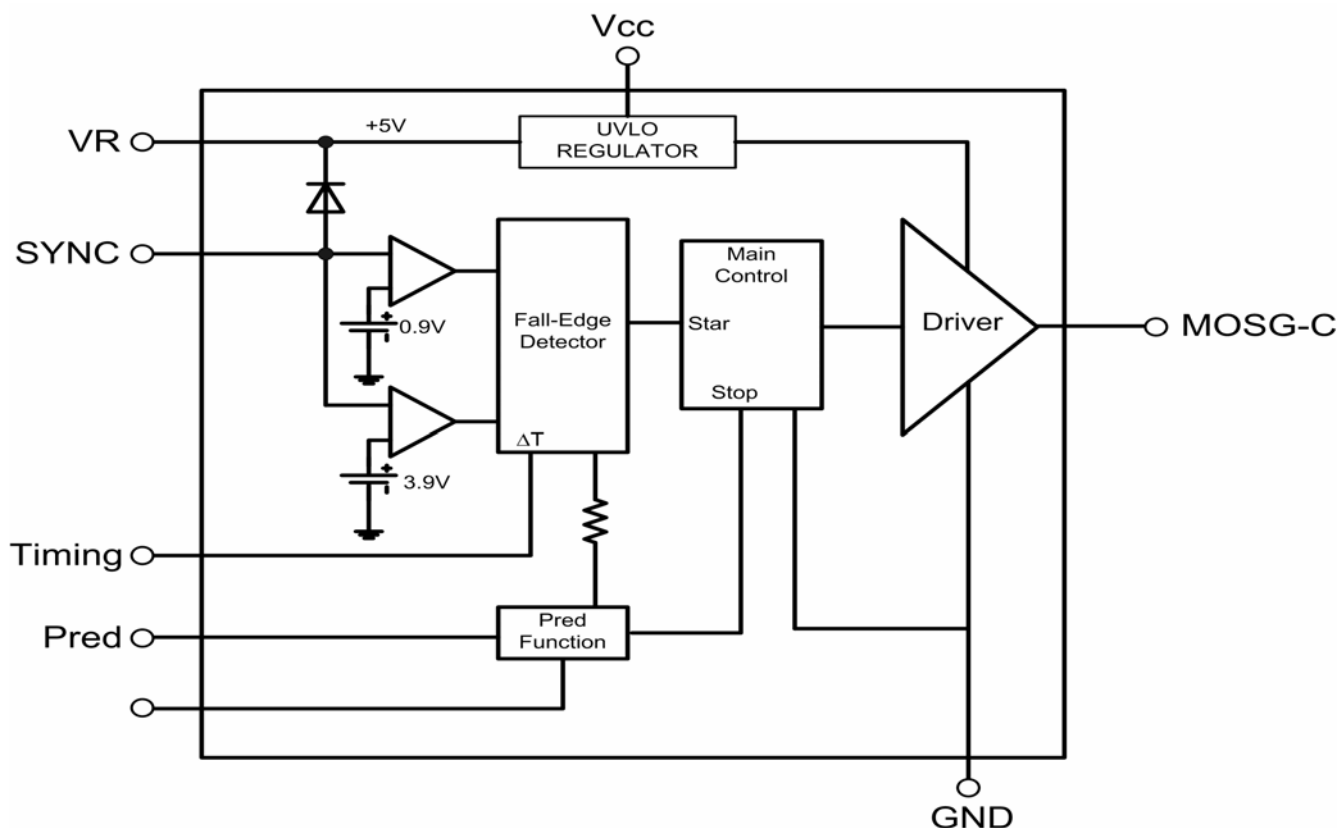
| Pin | Symbol | Description   |
|-----|--------|---|
| 1   | Timing | Discontinuous current filter timing adjustment resistor connection. |
| 2   | Pred   | Capacitor to store previous cycle timing for Catch MOSFET           |
| 3   | VR     | Voltage Regulator   |
| 4   | Cramp  | Ramp capacitor adjustment to extend MOSFET's gate timing.           |
| 5   | GND    | Ground connection.  |
| 6   | MOSG-C | Catch MOSFET gate drive.  |
| 7   | Vdd    | DC supply voltage.  |
| 8   | SYNC   | Synchronized signal from transformer's output.                      |



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### BLOCK DIAGRAM



### ORDERING INFORMATION

| Part Number | Package | Part Marking |
|-------------|---------|--------------|
| SP6013AS8RG | SOP-8   | SP6013AI     |
| SP6013AS8TG | SOP-8   | SP6013AI     |

※ SP6013AS8RG : 7" Tape Reel ; Pb – Free

※ SP6013AS8TG : Tube ; Pb – Free

### ABSOLUTE MAXIMUM RATINGS (TA=25°C, unless otherwise specified.)

The following ratings designate persistent limits beyond which damage to the device may occur.

| Symbol            | Parameter                                    | Value      | Unit |
|-------------------|--|------------|------|
| V <sub>dd</sub>   | DC Supply Voltage                            | 17         | V    |
| SYNC              | SYNC Voltage                                 | 7          | V    |
| I <sub>OUT</sub>  | Peak Source Current (Pulsed)                 | 3          | A    |
|                   | Peak Sink Current (Pulsed)                   | 3          | A    |
| P <sub>D</sub>    | Power Dissipation @ T <sub>A</sub> =85°C (*) | 0.25       | W    |
| T <sub>J</sub>    | Operating Junction Temperature Range         | -40 to 125 | °C   |
| T <sub>STG</sub>  | Storage Temperature Range                    | -40 to 150 | °C   |
| T <sub>LEAD</sub> | Lead Soldering Temperature for 5 sec.        | 260        | °C   |



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### THERMAL RESISTANCE

| Symbol          | Parameter                              | Value | Unit          |
|-----------------|--|-------|---------------|
| $R_{\theta JC}$ | Thermal Resistance Junction – Case (*) | 45    | $^{\circ}C/W$ |

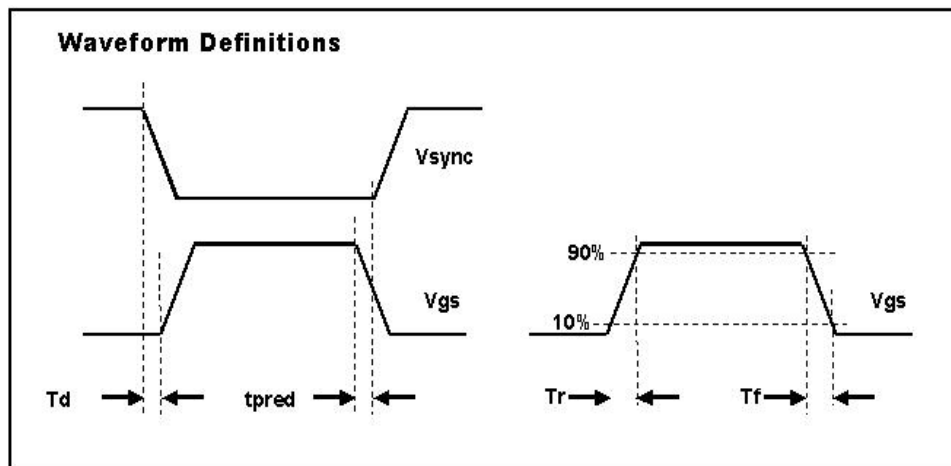
(\*) The power dissipation and thermal resistance are evaluated under copper board mounted with free air conditions.

### ELECTRICAL CHARACTERISTICS

( $T_A=25^{\circ}C$ ,  $V_{dd}=12V$ , Freq. =300 KHz, Duty Cycle=50%, unless otherwise specified.)

| Symbol                             | Parameter              | Conditions              | Min. | Typ. | Max. | Unit |
|------------------------------------|------------------------|-------------------------|------|------|------|------|
| <b>SUPPLY INPUT</b>                |                        |                         |      |      |      |      |
| IDD                                | Supply current         | No load                 |      | 10   | 16   | mA   |
|                                    |                        | $V_{SYNC}=0V$ , No load |      | 7.5  | 10   | mA   |
| Vonh                               | Vdd turn on threshold  |                         |      | 9.5  | 10   | V    |
| Voffh                              | Vdd turn off threshold |                         | 8    | 8.5  |      | V    |
| <b>SYNC REFERENCE (SYNC)</b>       |                        |                         |      |      |      |      |
| Vshth                              | SYNC high threshold    |                         | 3.9  | 5.0  |      | V    |
| Vslth                              | SYNC low threshold     |                         |      | 0.9  | 1.2  | V    |
| <b>MOSFET GATE DRIVER (MOSG-C)</b> |                        |                         |      |      |      |      |
| Voh                                | Output high voltage    | $I_o = -200mA$          | 11.5 | 11.8 |      | V    |
| Vol                                | Output low voltage     | $I_o = 200mA$           |      | 0.1  | 0.2  | V    |
| Td                                 | Propagation delay      | No load                 | 15   | 35   |      | ns   |
| Tpred                              |                        | No load                 |      | 120  |      | ns   |
| Tr                                 | Rise time              | Load = 1nF (*)          |      | 10   | 25   | ns   |
| Tf                                 | Fall time              | Load = 1nF (*)          |      | 10   | 25   | ns   |

(\*)  $T_r$  &  $T_f$  are measured among 10% and 90% of starting and final voltage.





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PERFORMANCE CHARACTERISTICS ( $T_A=25^\circ\text{C}$ , unless otherwise specified.)

Figure 1 : Supply Current vs Supply Voltage

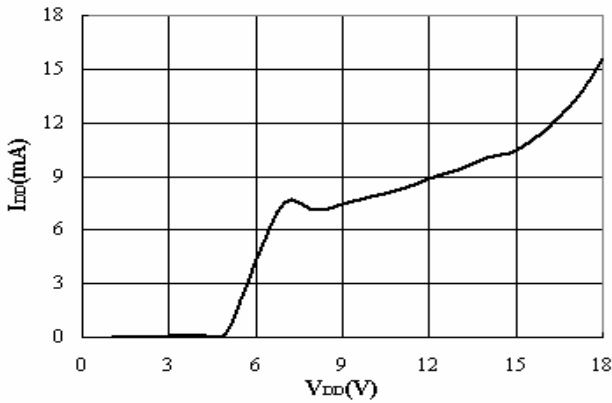


Figure 2 : Supply Current vs Freq. @ No Load

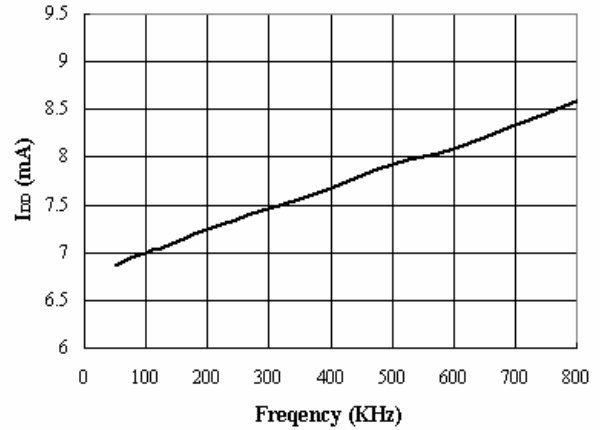


Figure 3 :  $T_{pred}$  vs  $C_{pred}$  @ Freq = 70 KHz ;  $V_{DD}=10V$

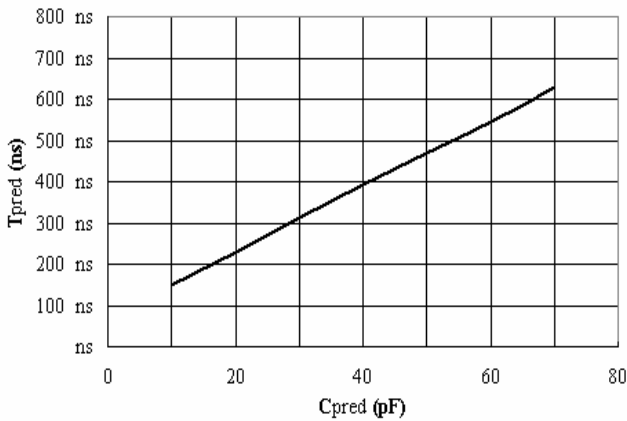


Figure 4 : Output Rise Time vs Load Capacitor

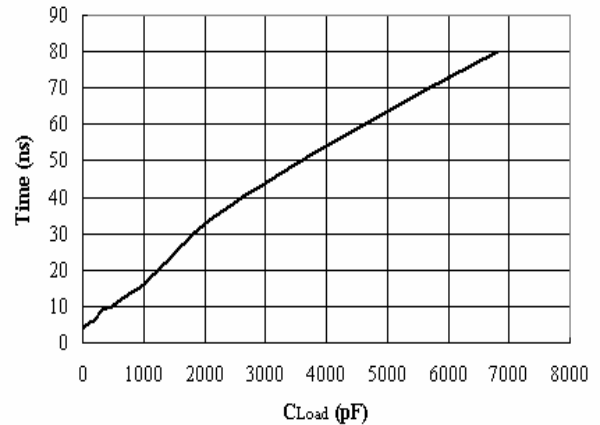


Figure 5 : Output Fall Time vs Load Capacitor

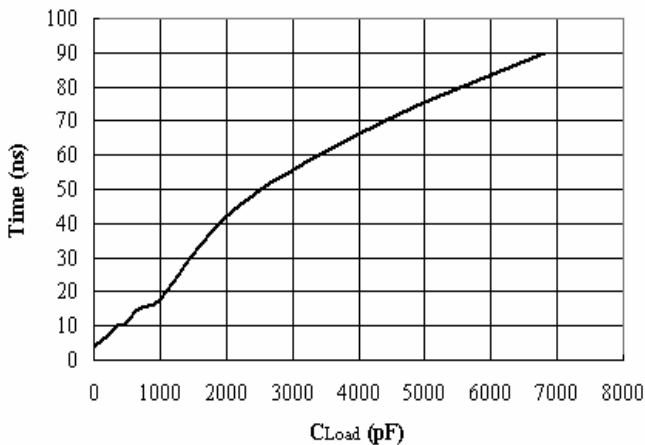
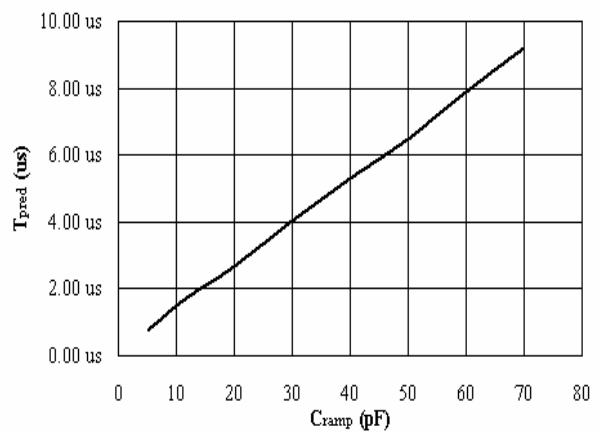


Figure 6 :  $T_{pred}$  vs  $C_{ramp}$  @ Freq = 20 KHz



\*Fig. 1 : No Load ; No SYNC

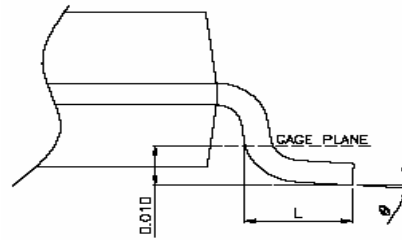
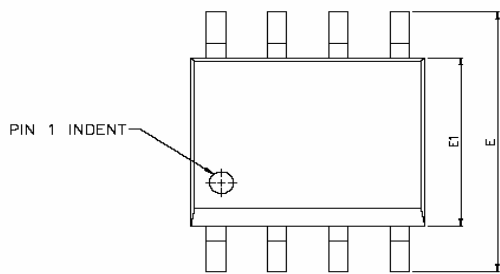
\*Fig. 4-5 : Frequency = 65 kHz.



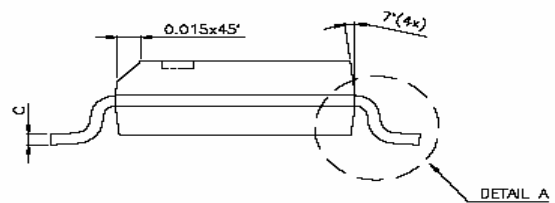
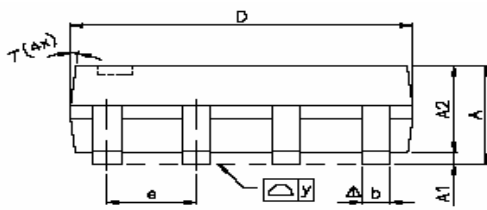
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### SOP-8 PACKAGE OUTLINE



DETAIL A



| SYMBOLS       | DIMENSIONS IN MILLIMETERS |      |       | DIMENSIONS IN INCHES |       |        |
|---------------|---------------------------|------|-------|----------------------|-------|--------|
|               | MIN                       | NOM  | MAX   | MIN                  | NOM   | MAX    |
| A             | 1.47                      | 1.60 | 1.73  | 0.058                | 0.063 | 0.068  |
| A1            | 0.10                      | —    | 0.25  | 0.004                | —     | 0.010  |
| A2            | —                         | 1.45 | —     | —                    | 0.057 | —      |
| b             | 0.33                      | 0.41 | 0.51  | 0.013                | 0.016 | 0.020  |
| C             | 0.19                      | 0.20 | 0.25  | 0.0075               | 0.008 | 0.0098 |
| D             | 4.80                      | 4.85 | 4.95  | 0.189                | 0.191 | 0.195  |
| E             | 5.80                      | 6.00 | 6.20  | 0.228                | 0.236 | 0.244  |
| E1            | 3.80                      | 3.90 | 4.00  | 0.150                | 0.154 | 0.157  |
| e             | —                         | 1.27 | —     | —                    | 0.050 | —      |
| L             | 0.38                      | 0.71 | 1.27  | 0.015                | 0.028 | 0.050  |
| $\Delta$ y    | —                         | —    | 0.076 | —                    | —     | 0.003  |
| $\varnothing$ | 0°                        | —    | 8°    | 0°                   | —     | 8°     |



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